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Natural Gas Storage Value Assessment

Presented to:

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Staff Workshop on
Natural Gas Storage Research

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Material presented is drawn from preliminary results of research conducted under Task 2, Western States Gas Market Modeling, California Energy Commission (CEC) PIER Natural Gas Program.

The views presented here are the views the Author and do not reflect the views of CIEE or members or staff of the California Energy Commission.

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  - Model Objective
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Modeling Approach: Objective of Developed Model

- Developed framework projects gas infrastructure utilization in the Western States, including California, at a very detailed level.
  - Solves for pipeline throughput and storage field utilization under a wide range of market conditions.
- Determines the value of storage under a wide range of market conditions.
  - For example, the model assesses utilization of individual storage fields considering different weather scenarios, different supply conditions, and disruptions to pipeline infrastructure.

Modeling Approach: Framework – Models Utilized for the Work

- Gas Market Model (GMM) – Projects supply, demand, and prices for North American natural gas market.
  - Model solves for gas supply and demand at market clearing prices at a series of market hubs or "nodes" throughout North America.
  - Model provides boundary conditions (input parameters) for Western States modeling framework.
- Daily Gas Load Model (DGLM) – Calculates daily gas loads for Western States Modeling framework.
- Regional Infrastructure Assessment Modeling System (RIAMS) – Adapted to model infrastructure utilization in the Western States.
  - Model solves for pipeline and storage utilization.
  - Determines the value of storage fields and pipeline infrastructure.

Modeling Approach: Western States Modeling Framework

Gas Market Model (GMM)

Well established model operating since 1997

Projects monthly values for gas supply, demand, and prices throughout the U.S. and Canada

Monthly gas consumption and prices

Daily Gas Load Model (DGLM)

Projects daily gas requirements by sector for many areas throughout North America

Daily loads provided for normal or actual weather

Boundary Conditions for Western States, Including Regional Prices, Supply Curves, Demand Curves, Import and Export Targets for Transport To and From the Area, and Beginning and End of Year Working Gas Levels

Gas Prices and Pipeline and Storage Utilization

Daily Demand Curves

Regional Infrastructure Assessment Modeling System (RIAMS) – Monthly Version

Detailed regional assessments of gas infrastructure utilization and adequacy

Models utilization of individual storage fields and utilization of specific pipeline facilities

Projects monthly activity from Nov 2005 through Oct 2010; 1 "backcast" year and 4 forecast years

Supply Curves, Import and Export Targets for Transport To and From the Area, and Beginning and End of Month Working Gas Levels

Regional Infrastructure Assessment Modeling System (RIAMS) – Daily Version

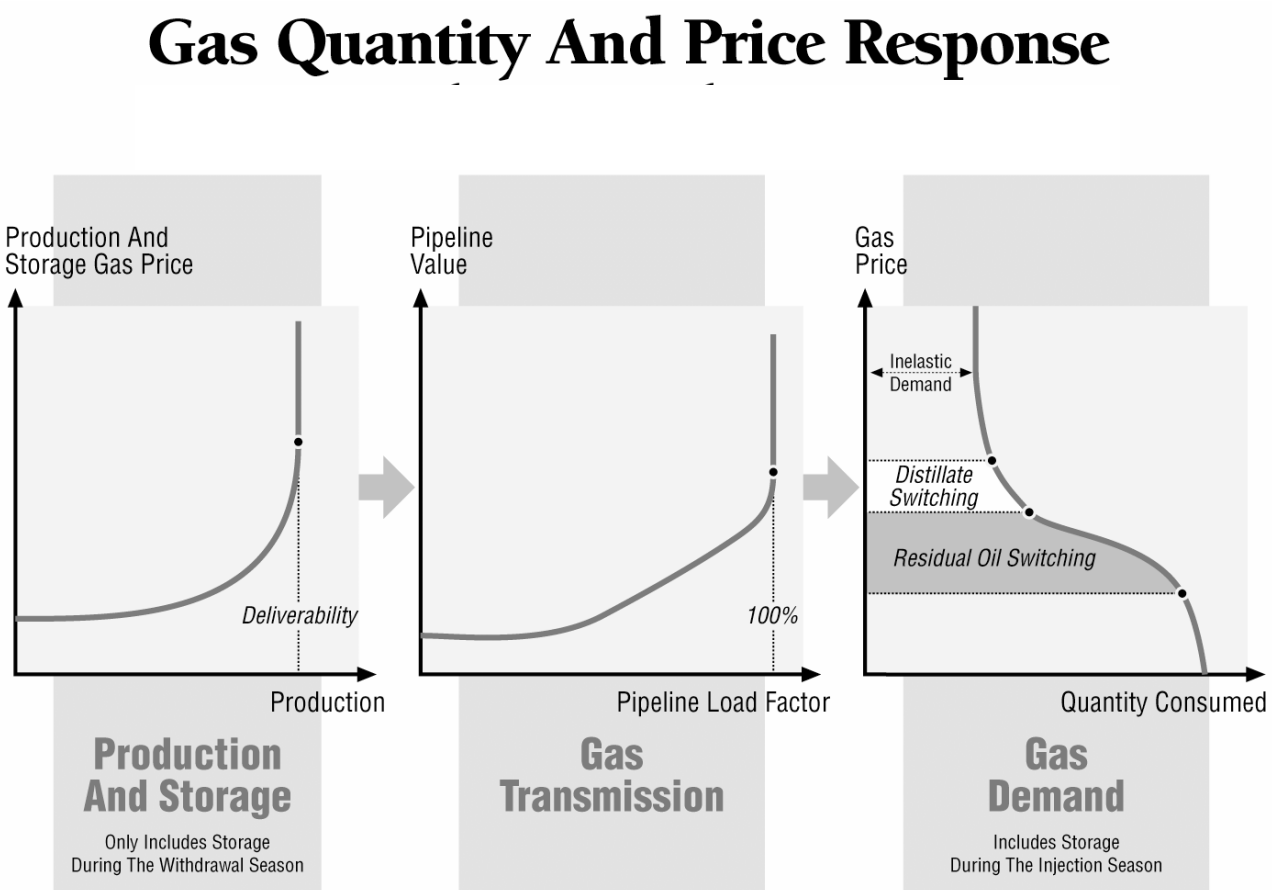
Detailed regional assessments of gas infrastructure utilization and adequacy

Models utilization of individual storage fields and utilization of specific pipeline facilities

Projects daily activity during a peak month to assess adequacy of infrastructure for peak day requirements

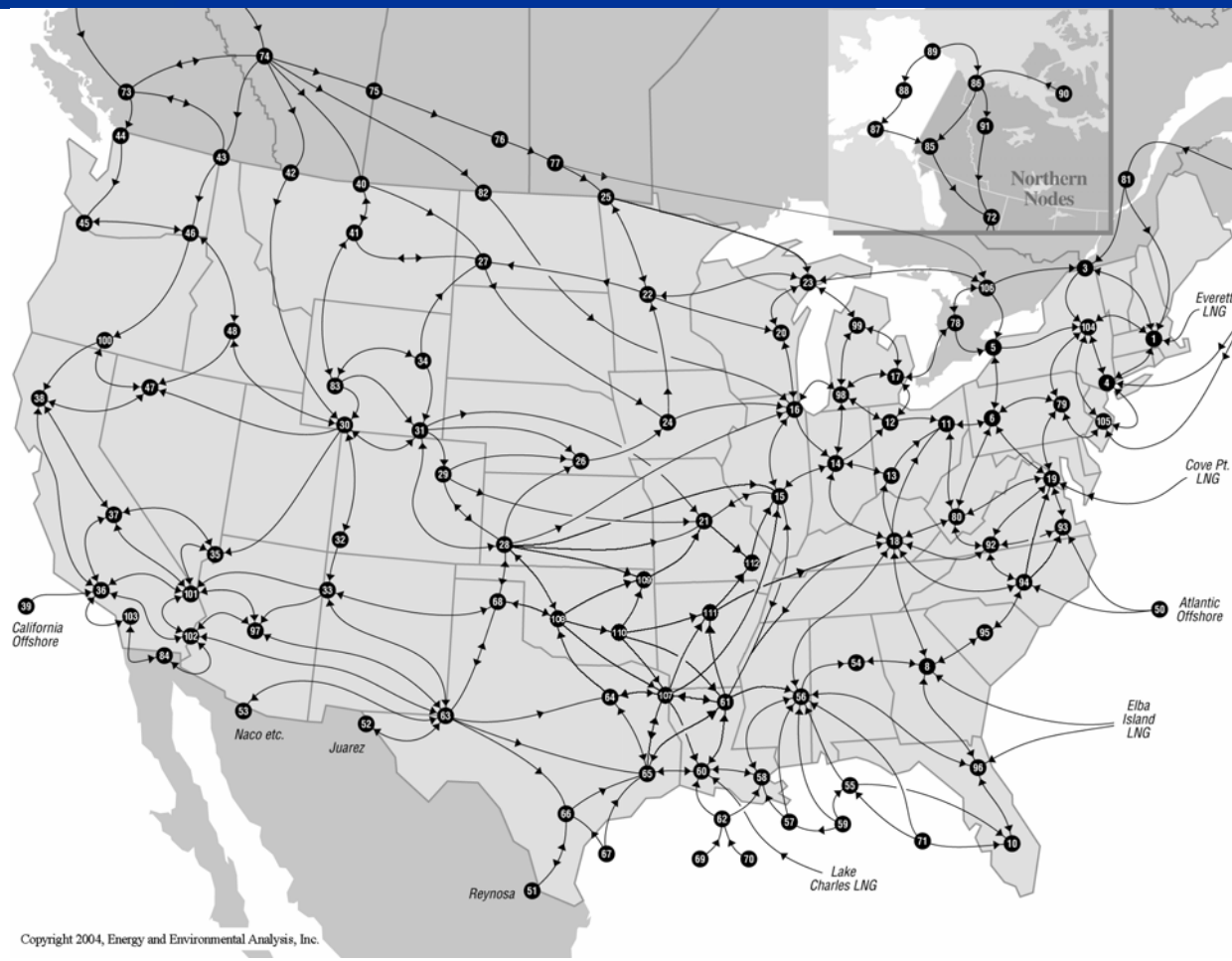
GMM Overview

1) Model solves supply/demand balances at market clearing prices on a monthly basis
2) Supply and demand respond to solved prices
3) Model considers impacts of new infrastructure and new supplies



GMM Transmission Network

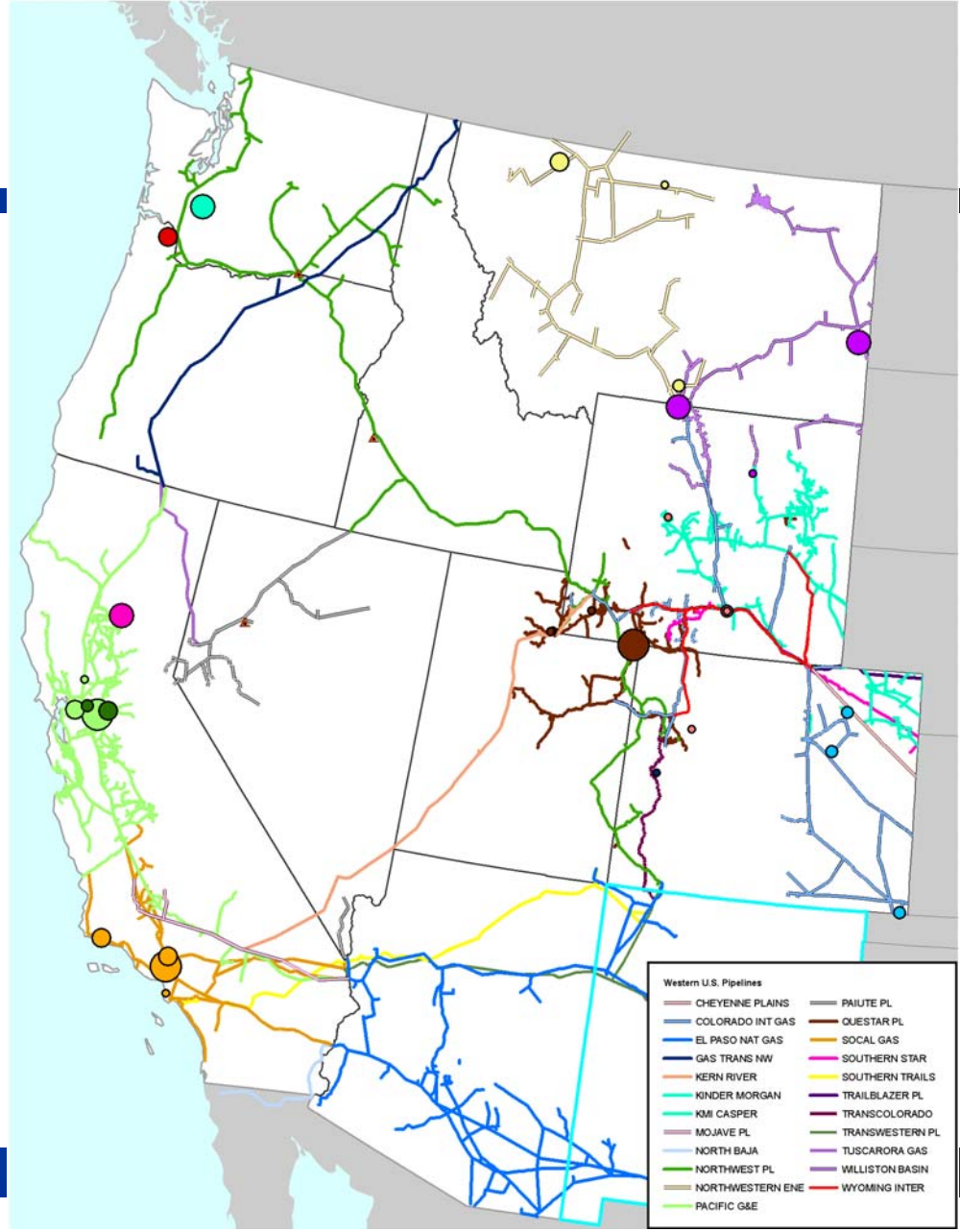
1) Pipeline network includes major supply hubs, market centers, and major points of interconnection between pipelines
2) 114 nodes and over 350 corridors
3) Supply/demand balances and prices solved at each node



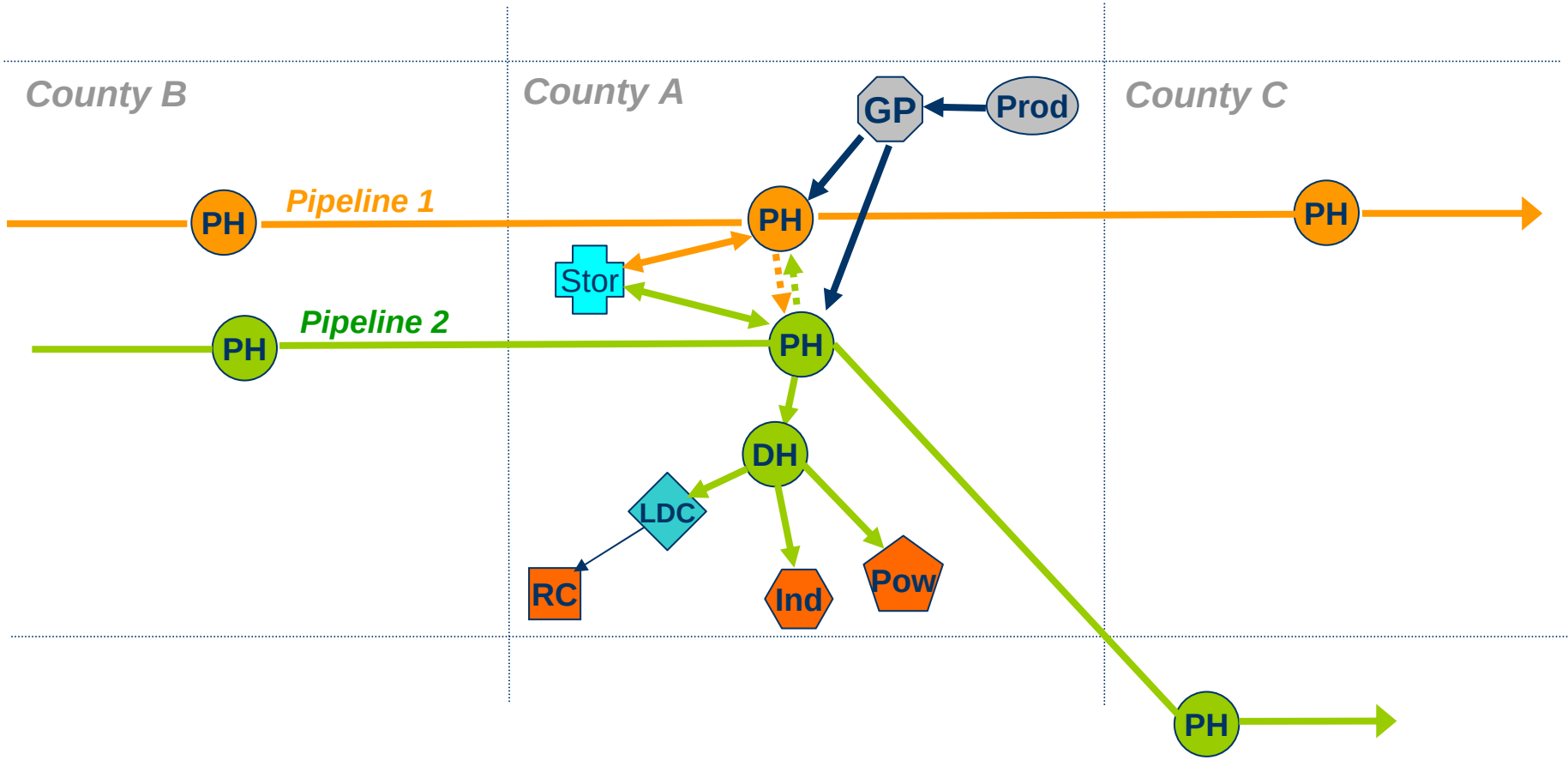
RIAMS Overview

Gas Pipeline Systems	38
Storage Fields	37
Gas Processing Plants	85
Power Plants	175
Large Industrial Facilities	414
Pipeline Interconnects	214
2005-06 Core Consumption	1,533 Bcf
2005-06 Non-Core Consumption	2,744 Bcf
2005-06 Production	4,271 Bcf
2005-06 Imports to Area	1,351 Bcf
2005-06 Exports from Area	1,314 Bcf
Total Nodes	2,439
Total Links	3,102

Note: All 2005-06 values are for Nov 2005 through Oct 2006.



Example of RIAMS Node Configuration



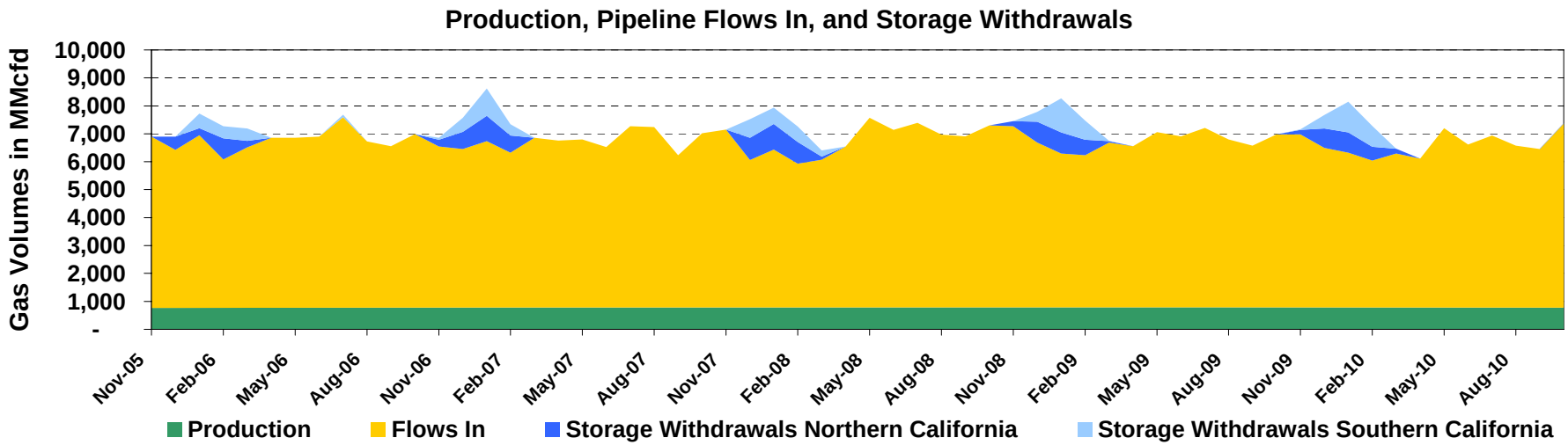
Status of Model Development

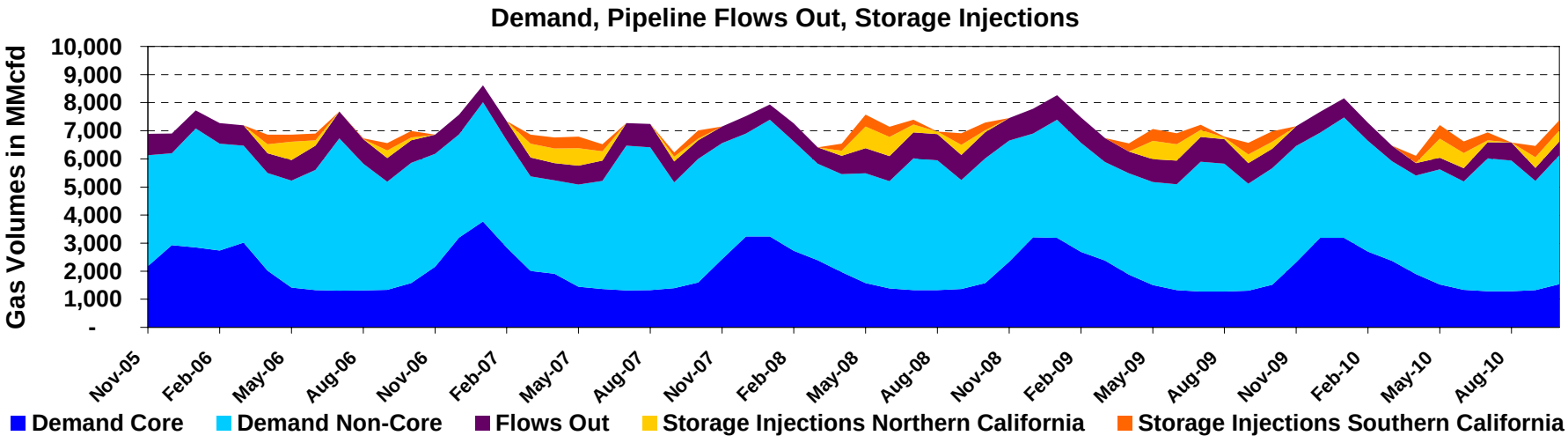
- GMM scenario for North America complete. Boundary conditions being passed to West Coast version of RIAMS.
- RIAMS West Coast Monthly Version fully operational.
  - Draft of monthly results for Base Case complete.
- RIAMS West Coast Daily Version under development.
  - Expected to be complete in December 2007.
  - Daily load curves ready.
  - Base Case to be run through RIAMS West Coast Daily Version after Daily Version is operational.
- Base Case with daily results will be complete in December 2007.

Some Key Findings for Base Case

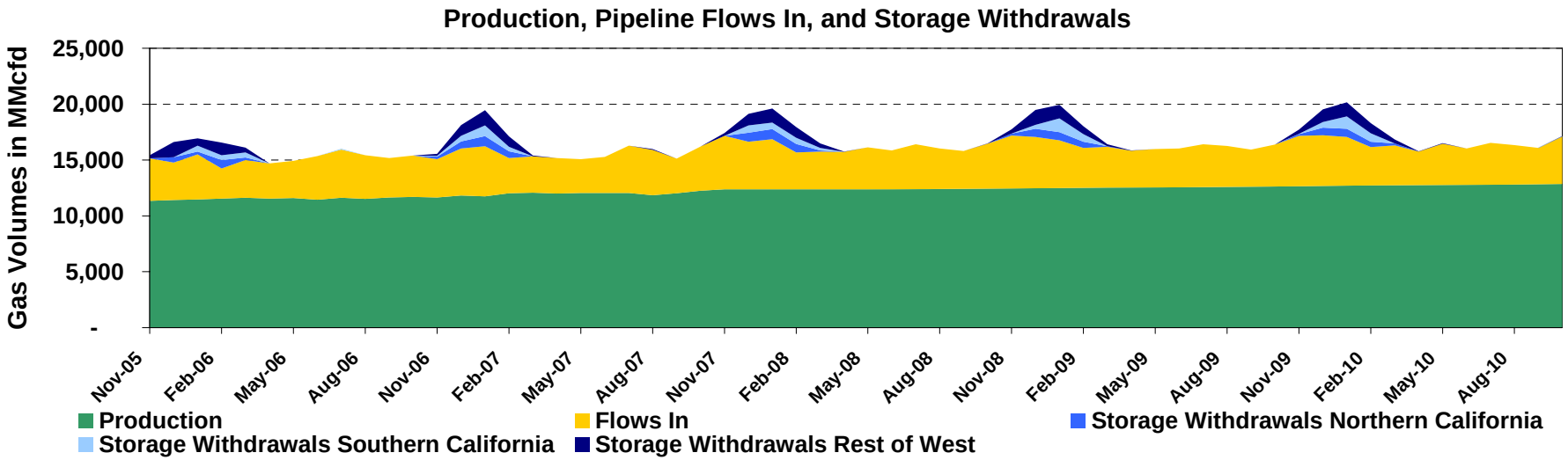
- California gas demand is not likely to grow by much during the next few years.
  - Relatively slow growth in gas use with renewed interest in conservation and significant growth in renewables generation is expected.
    - Annual consumption over the next 4 years ranges from 2,179 Bcf to 2,219 Bcf, very similar to recent annual consumption of 2,201 Bcf.
- During the next few years, California infrastructure is utilized at about the same levels as those recently observed in the market.
  - Net imports from "traditional supply areas", that is the Rockies, San Juan Basin, Permian Basin, and Western Canada, are likely to decline as LNG imports begin at Costa Azul.
    - Even some significant infrastructure changes, for example, startup of transport on REX, are not likely to change California import/export activity by much.
  - Assuming normal weather during the next few years, California's storage utilization will be slightly greater than recent historical utilization, as gas load in power generation grows and market variability increases.
    - California's annual storage turnover will average just above 130 Bcf, a little above the 2005-06 level of 110 Bcf. Storage will continue to be utilized as it has been during the past few years.

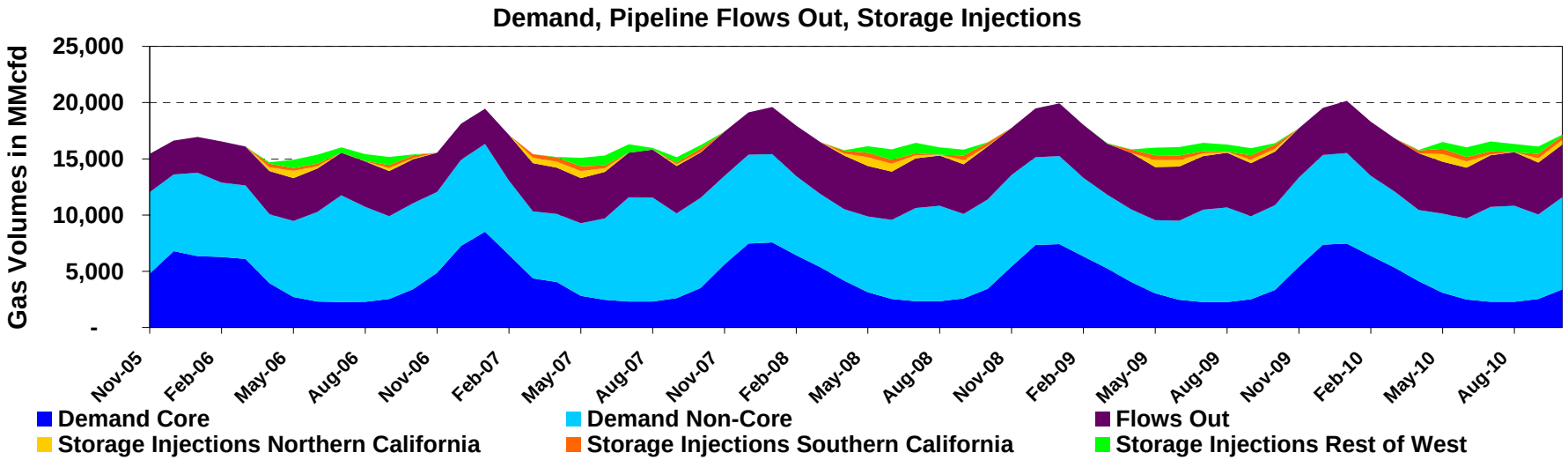
Select Results of the Base Case
California Monthly Gas Balance in MMcfd



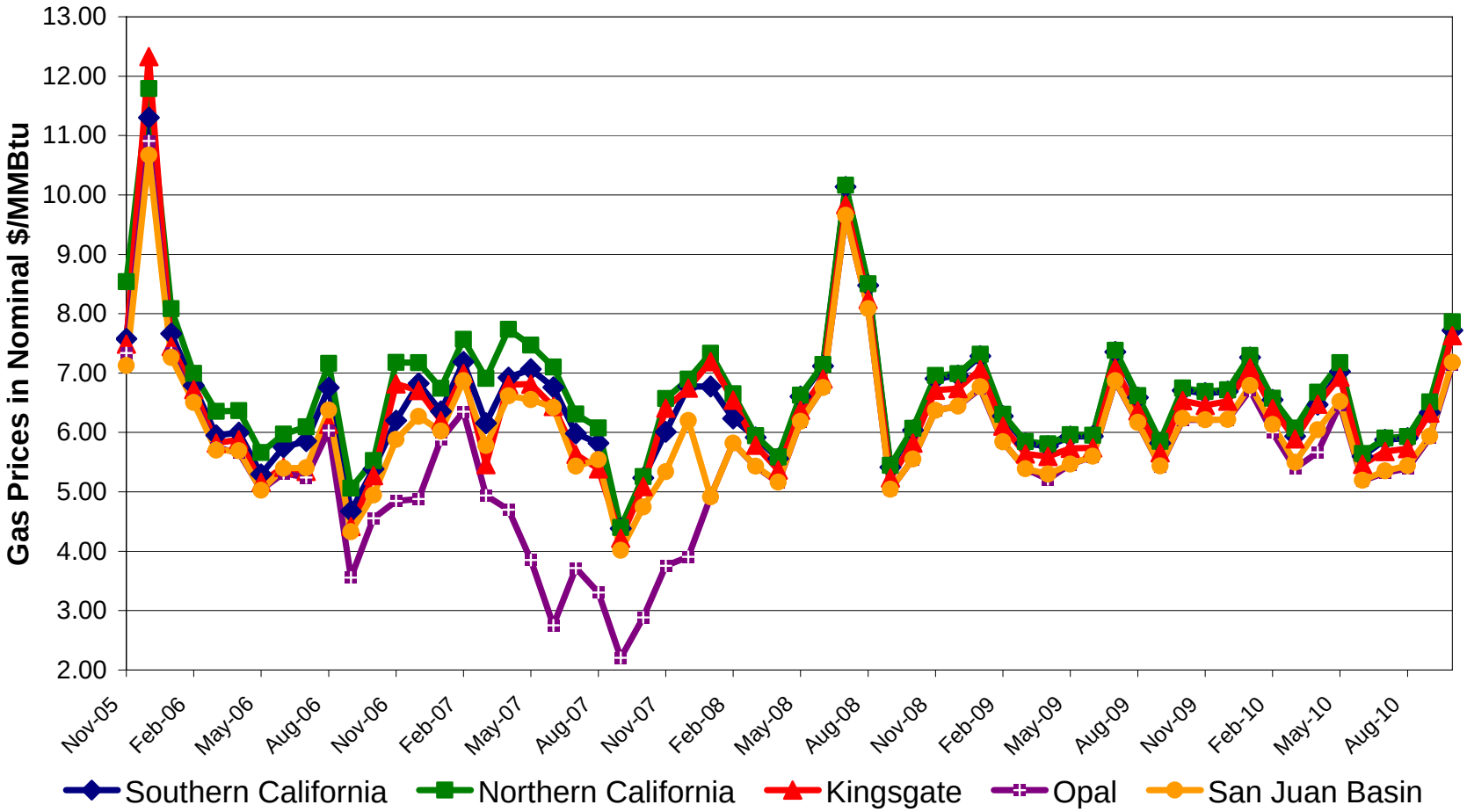


Select Results of the Base Case
Western U.S. Monthly Gas Balance in MMcfd





Select Results of the Base Case
Regional Gas Prices in Nominal $/MMBtu



Next Steps

- Complete Daily Version of RIAMS and provide daily results for Base Case. Planned completion December 2007.
- Complete Alternate Scenario work. Work to be conducted during the end of 2007 and first half of 2008.
- Complete Storage Valuation analysis. To be completed during summer 2008.

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